

STUDY EFFECT ELECTROMAGNETIC FIELD (EMF) AND MOBILE PHONE RADIATION ON SOME HEMATOLOGICAL, BIOCHEMICAL AND HORMONAL PARAMETERS IN FEMALE RATS.

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ABSTRACT

This study was conducted to investigate the effect of Electromagnetic field (EMF) and mobile phone radiation on some hematological, biochemical and hormonal levels. This study was achieved on 36 mature female rat, divided in to three groups each one consist of 12 animal , first group was control groups without exposure to any effects. Second group was exposed to electromagnetic field(50- 60 Hz) for 30 minutes daily for 45 days, third group was exposed to Mobile phone radiation for 30 minutes and the period of exposed was daily for 45 days. Blood samples were collected from treated and control rats about 6ml divided in to two tubes one with anticoagulation for complete blood test and other without anticoagulation for hormonal and biochemical analysis. Results revealed that there were significant($p \leq 0.05$) decrease in RBC count when exposed to electromagnetic field and mobile radiation while that there were significant($p \leq 0.05$) increase in WBC when were exposed to electromagnetic field. While there were significant($p \leq 0.05$) decrease in WBC when female rats were exposure to mobile phone radiation. There were significant ($p \leq 0.05$) increase in cholesterol and triglyceride when exposed to electromagnetic field and mobile phone radiation, there was significant ($p \leq 0.05$) decrease in FSH level in mobile phone radiation group in compared with control and

magnetic groups. Significant ($p \leq 0.05$) decreased in LH level of mobile groups compared with control groups.

INTRODUCTION

With the development of modern science and technology, more and more electronic products gained popularity in daily life, so that human surrounded by electromagnetic field (EMF) and extremely low frequency field (ELF)[1]. Several efforts have been made lately to investigate the onset of electromagnetic field on human and animal physiology and behavior [2 , 3]. The researches that seemed to explain a positive or negative affected on blood and serum or plasma chemistry of diabetic and healthy rats were studied [4].

The possible health effects of magnetic field on reproduction and endocrine system have been extensively studied [5, 6].

The wide use of mobile phone has inevitably raised the question of whether they have any implications on human health or could possibly cause some unexpected adverse health effects in human. It has been suggested, for example, that the use of mobile phone induces brain tumors or promotes cancer development and have other effects on biological systems. Most of these effects are traceable to even small thermal fluctuations [7,8].

Mobile phone is radio devices transmit and receive radio frequency radiation at 800-2000 MHz[9].

The health problems most commonly attributed to the use of mobile Phone handsets were impairment of short-term memory, headaches, brain tumors, other cancers, sleep disturbance, depression, tiredness, neuroendocrine function, miscarriages and semen quality impairment [10].

MATERIALS AND METHODS

sixty healthy adult female laboratory rats their mean body weight was (200-240) g they were randomly divided into three experimental groups of twelve animals for each, they were housed in the animal house of veterinary medicine college.

First group was severed as control, second group exposed to electromagnetic field, and the third group exposed to mobile radiations. All animals were kept at similar conditions at room temperature(20-25) C° free access of food and water *ad libitum* and alternate 12h light/dark and each four of experimental animals were reared in one cage.

Adult female rats were exposed to static magnetic field (SMF) and mobile phone radiation for 30 minutes a day for 45 successive days and regarded as exposed groups. The control rats group was positioned at the same place for 30 minute a day for 45 days without applying magnetic field from tested and control rats, blood collected in different intervals 0,15,30,45,days by scarified of animal and the blood sample divided in two tubes about one ml were collected in vials containing EDTA for hematological analysis , other blood sample was (5)ml were collected in vial without any coagulant agents and immediately centrifuged to get serum which were frozen at -20 C° for hormonal and biochemical analysis later .

Hematological analysis: included Red Blood Cells count (RBC) and Total White Blood Cell count (WBC) were obtained as described by[11].

Biochemical analysis: Included total serum cholesterol determination kit total serum triglyceride

Hormonal analysis:

Estimation of each of fertility hormone follicle stimulating hormone (FSH) and the luteinizing hormone (LH).

RESULTS

The obtained results in (table- 1) revealed significant $p \leq 0.05$ decrease in in the RBC count in both magnetic and mobile groups when compared with control groups in 15 day of experimental period (Table- 1). And when compared between the period in the same group the result showed significant $p \leq 0.05$ decrease in RBC count in magnetic and mobile groups in 15 day. The result also showed significant $p \leq 0.05$ increased in WBC count in magnetic and mobile groups compare with control group. And when compare this result in same group with different intervals the result showed significant $p \leq 0.05$ decrease in WBC count in 30 and 45 day in electromagnetic and mobile groups of experimental period.

Table (1) Effect the electromagnetic field and mobile on RBC, WBC count in female rats mean±SD

Parameters	Group N=20	Treatment period			
		0 day	15 day	30 day	45 day
RBC ($10^6/\text{mm}^3$)	Control	5.71 ± 0.45	6.30 ± 0.52	6.48 ±0.19	6.76 ±0.17
	Magnetic	5.65 ±0.36	3.39* ±0.39**	6.23 ±0.65	6.62 ±0.32
	Mobile	5.66 ±0.53	3.06* ± 0.28**	6.84 ±0.24	6.52 ±0.59
LSD		0.90			
WBC ($10^3/\text{mm}^3$)	Control	10.90 ±2.25	6.60 ±2.42	6.76 ±1.44	5.70 ±2.70
	Magnetic	10.23 ±2.30	15.56* ±1.47**	9.73* ±3.84	9.30 ± 2.29
	Mobile	10.53 ± 6.12	17.40* ±1.70**	7.40 ±2.43	4.90* ±3.65
LSD		5.08			

The results in (table - 2) indicated significant ($p \leq 0.05$) increased in total cholesterol level in magnetic and mobile groups when compared with control group during period between 30 days and 45 days.

In each two groups when the level of cholesterol compared in different of experimental, there were significant $p \leq 0.05$ increase in the cholesterol level in 30 days and 45 days in each magnetic and mobile groups.

The result of triglyceride level showed significant $p \leq 0.05$ increase in the mobile group between 30 and 45 and significant increase in magnetic only 45 days.

When compared the result in each two groups with different periods of experiment result showed significant increase in triglyceride level in mobile and magnetic group in the same periods as that compared with control group.

Table (2) Effect the electromagnetic field and mobile on serum total cholesterol and triglyceride levels in female rats means \pm SD

Parameters	Group N=20	Treatment period			
		0 day	15 day	30 day	45 day
CHOLESTROL (mg/dl)	Control	37.66 \pm 6.42	36.00 \pm 4.58	36.66 \pm 3.05	34.00 \pm 3.60
	Magnetic	31.83 \pm 4.07	37.33 \pm 11.50	47.66* \pm 6.11	58.00* \pm 13.11**
	Mobile	34.48 \pm 4.24	40.81 \pm 3.63	48.86* \pm 6.11	59.66* \pm 14.50**
LSD		13.67			
TRIGLYCERID (mg/dl)	Control	31.33 \pm 2.51	34.40 \pm 7.21	32.00 \pm 4.35	34.66 \pm 6.50
	Magnetic	31.83 \pm 4.07	36.33 \pm 5.77	35.83 \pm 4.04	51.33* \pm 9.07**
	Mobile	33.00 \pm 8.54	42.10 \pm 4.90	58.33* \pm 6.50**	54.00* \pm 4.35**
LSD		9.89			

The results in (table3) referred to significant $p \leq 0.05$ increased in FSH and LH level in both magnetic groups and control groups when compare with other experimental groups in 30 days period and when compared this result in all groups with different experimental the result conducted also significant increase in the level

of FSH in the magnetic and control groups in the 30 day period compare with 0 day period.

Table (3) effect the electromagnetic field and mobile on FSH, LH. Hormone levels in female rats mean \pm SD

Parameters	Group N=20	Treatment period			
		0 day	15 day	30 day	45 day
FSH (IU/l)	Control	5.40 \pm 0.72	6.46 \pm 0.51	7.26** \pm 0.90*	5.63 \pm 0.66
	Magnetic	5.06 \pm 0.50	5.86 \pm 0.41	6.93** \pm 0.40*	5.40 \pm 0.45
	Mobile	5.30 \pm 0.70	5.76 \pm 0.15	5.20 \pm 0.95	5.16 \pm 1.23
LSD		1.63			
LH (IU/l)	Control	4.23 \pm 0.51	5.16 \pm 0.50	5.40** \pm 0.78*	4.76 \pm 0.35
	Magnetic	4.03 \pm 0.20	4.80 \pm 0.41	5.60** \pm 0.30*	4.40 \pm 0.60
	Mobile	4.10 \pm 0.60	4.30 \pm 0.10	4.20 \pm 1.10	4.16 \pm 1.43
LSD		1.14			

- *Refer to significant $p \leq 0.05$ between groups
- ** Refer to significant $p \leq 0.05$ with in groups

DISCUSSION

The results in (table1) indicated a significant ($P < 0.05$) decrease in the RBC count in both of magnetic and mobile groups when compared with control groups.

This result agree with [12] who found that there was relationship between exposure to an electromagnetic field and a decrease in some whole blood count parameters when use EMF (0.97 mT 3h/day for 50 consecutive days). And he indicated that the EMF exposure applied may induce slight but statistically significant alterations in certain hematological parameters in rats.

Moreover,[13] found that exposure to EMF resulted in deterioration of RBCs function and metabolic activity, it was expected that, the increase of toxicity in specific organs was a result of the RBCs functional failure. Therefore, changes in antioxidants may be due to the deterioration in cellular membrane properties in the liver. In addition to increase toxicity in different organs.

On the other hand this study present increase in WBC which is a contrary with result of [14]who reported decline in number of leukocytes, lymphocytes, monocytes and eosinophils in mice depending on the duration of exposure to magnetic field. In contrast, in human (15) found that exposure to under electromagnetic field has been caused an increase in the white blood cells.

Also [16]found significant increase of WBC count due to exposure to electromagnetic field in compared with control group .

The results in (table-2)showed a significant increase in cholesterol level in magnetic and mobile groups when compared with control group.and triglyceride level showed significant increase in magnetic and mobile groups when compare with control group.

[17]reported that exposure of female rabbits to electromagnetic field at 104 μ T caused a significant increase triglycerol ,HDL as well as significant decreased in serum cholesterol, LDL. that opinion disagreement with the result of this study.

A therapeutic effect of EMF on obesity and complicated hyper lipidemia . single exposure to electromagnetic field (EMF) increase the serum values of HDL-c and decreased total cholesterol concentration of rat liver [18].On the other hand, a beneficial effect of EMF was also reported in diet induced hyper cholesterolemic rabbit, where pulse of EMF lowered total cholesterol and triglyceride level [19]. Similar results were found in rats [20] and mice [21] as well as in human.

The results in (table-3)referred to a significant increase in FSH and LH hormone level in magnetic groups and control groups when compared with other experimental groups in 30 days period .

[22] observed at the hypothalamic levels, hyperprolactinemia can cause impairment of pulsatile GnRH release. [23] reported that the gonadal increase in prolactin serum level in the exposed groups may be one of the factors that lead to the gradual decrease of FSH level in the exposed groups, but does not explain the rise of LH level in the group exposed to the magnetic field for four weeks.

It can be seen that some studies reported that EMF caused a change in hematological parameters, whereas others reported no change. The reason for these conflicting results probably stems from differences in exposure setups, experimental conditions such as an alternative or static MF, the frequency, different intensities and duration time of MF, time of recovery, investigation targets and assay methods [24].

دراسة تأثيرات المجال الكهرومغناطيسي (EMF) وإشعاعات الهاتف المحمول على بعض المعايير الدموية، والكيميوحيوية والهرمونية لإناث الفئران.

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الخلاصة

أجريت هذه الدراسة لمعرفة تأثيرات المجال الكهرومغناطيسي (EMF) وإشعاعات الهاتف المحمول على بعض معايير الدم وبعض المكونات الكيميوحيوية والهرمونية لإناث الجرذان البيضاء. أجريت هذه الدراسة على 36 أنثى جرذ بيضاء ناضجة قسمت إلى ثلاث مجموعات. المجموعة الأولى احتوت على 12 جرذ واعتبرت مجموعة سيطرة حيث لم تتعرض إلى أي تأثيرات، أما المجموعة الثانية احتوت على 12 أنثى جرذ أبيض فقد عرضت للمجال الكهرومغناطيسي شدة المجال (50-60 Hz) لمدة 30 دقيقة يوميا ولمدة 45 يوما، أما المجموعة الثالثة والتي احتوت نفس العدد من إناث الجرذان فقد عرضت لإشعاعات الهاتف الجوال لمدة 30 دقيقة يوميا لمدة 45 يوما أيضا. جمعت عينات الدم من جميع إناث الجرذان المعاملة للسيطرة بواقع 6 مللتر لكل مجموعة حيث قسمت كل عينة إلى قسمين، قسم يحتوي مانع تخثر الدم لغرض قياسات الصفات الدموية، والقسم الآخر لا يحتوي على مانع تخثر وذلك للحصول على مصل الدم لغرض قياس المعايير الكيميوحيوية والهرمونية. أظهرت النتائج وجود انخفاض معنوي ($p \leq 0.05$) في عدد كريات الدم الحمراء عند التعرض للمجال الكهرومغناطيسي وإشعاعات الهاتف المحمول بينما كان هناك زيادة معنوية ($p \leq 0.05$) في كريات الدم البيضاء عند التعرض للمجال الكهرومغناطيسي فقط بينما سببت إشعاعات الهاتف المحمول انخفاض في كريات الدم البيضاء.

سبب التعرض للمجال الكهرومغناطيسي إشعاعات الهاتف المحمول زيادة معنوية ($p \leq 0.05$) في الكوليسترول الكليوالكيسيريديتات الثلاثية وكذلك سبب التعرض للمجال الكهرومغناطيسي إشعاعات الهاتف

المحمول انخفاض معنويا ($p \leq 0.05$) في مستوى الهرمون المحفز للجريبات مقارنة مع مجموعات السيطرة ومجموعة المجال الكهرومغناطيسي. كذلك سبب إشعاعات الهاتف المحمول انخفاض معنويا ($p \leq 0.05$) في مستوى الهرمون اللوتيني مقارنة مع مجموعات السيطرة.

REFERENCES

- 1- Loomis D. S.,(1990).Mortality from brain cancer and leukaemia among electrical workers. *Br J Ind Med*, 47(9):633-8.
- 2- Mustafa RM.; Mustafa YM., Ali FM. and Shafik A., (2006). Sex hormone status in male rats after exposure to 50Hz,5 μ Tmagnetic field.Archives of Andrology, 52:363-369.
- 3- Mustafa RM. and Riedel A., (2002). Effects of exposure to extremely low frequency magnetic field of 2G intensity on memory and corticosterone level in rats. *Physiology and Behavior*, 6675: 1-7.
- 4-Seto YJ.;Majeau-Chargois D., Lymangrover JR.,(1986). Chronic 60-Hz electric field exposure-induced subtle bioeffects on hematology.*Environ Res*, 39:143–52.
- 5- Braune S. and Riedel A.,(2002). Influence of radio frequency electromagnetic field on cardiovascular and hormonal parameters of autonomic nervous system in healthy individual *Radiat.Res*,158:352-356.
- 6- Marino AA. and Wolcott RM., (2001). Coincident nonlinear changes in the endocrine and immune system due to low frequency magnetic fields. *Neuroimmuno modulation*, 9: 65-77.
- 7- Elder,J.A. and Chou C.K., (2003). Auditory response to pulsed radiofrequency energy.*Bioelectromagnetics*, 24(6): 162 -173.
- 8- Aran J.M.; Carrere N., Chalan Y., Duluo P.E., Larrieu S., Letenneur L., (2004).Effects of exposure of the ear to GSM microwaves: *in vivo* and *in vitro* experimental studies. *Int J. Audiol*, 43: 545 – 554.
- 9- Boris D;Dusan S., Dejan K.,Dejan P.,JovicJ.,Marjan M.,(2010).Biochemical and histopathological effects of mobil phone exposure on rat hepatocytes and brain. *Acts MedicaMedianae*, 49(1):37- 42.
- 10-Eurpean commission, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), (2007). "Possible effects of electromagnetic fields (EMF) on human health " , March 21,
- 11- Dasice J.V. and LewisS.M.,(2001). Practical hematology.8thed.,Edinburgh ,Churchill.:83.

- 12- Dilek U. C., Beran Y., Mehmet Z. A., Cemil S., and Nuriye M. (2009) Alterations of Hematological Variations in Rats Exposed to Extremely Low Frequency Magnetic Fields (50 Hz). *Archives of Medical Research*, 40:352-356
- 13- Qiu, C.; Fratiglioni, L.; Karp, A.; Winblad, B. and Bellander, T. (2004): Occupational exposure to electromagnetic fields and risk of Alzheimer's disease. *Epidemiology*, 15:687-694.
- 14- Bonhomme-Faiver L; Mace A, Bezie Y, Marino S, Bindoula G, Szekeley Frenois N, Auclair H, Arbouys OS and Bizi E. (1998). Alterations of biological parameters in mice chronically exposed to low-frequency (50Hz) electromagnetic fields. *Life Science*, 62 (14): 1271-1280.
- 15- Marino AA., (1995). Time-dependent hematological changes in workers exposed to electromagnetic fields. *Am IndHygAssoc J.* 56(2):189-92.
- 16- Hassan F.B., (2011). Sub chronic effects of electro magnetic field exposure of adult female rats on some hormonal, biochemical and hematological parameters. *Diyala Agricultural Sciences Journal*; 3(1): 47-53.
- 17- Hilal J. A. K.; Hassan B. F., Ali M. H., (2012). Study the effect of electromagnetic field on cortisol hormone some biochemical and hematological parameters in adult female rabbits. *AL-Qadisiya Journal of Vet.Med.Sci.*, 11 (2).
- 18- Torres-Duran, V.; Ferreira-Hermosillo A.; Juarez-Oropez, M.; Elias-Vins, D. and Verdugo-Diaz, L. (2007). Effects of whole body exposure to extremely low frequency electromagnetic fields (ELF-EMF) on serum and liver lipid levels, in the rat. *Lipids in Health and Disease*, 6: 31.
- 19- Luo, E.P.; Jiao, L.C.; Shen, G.H.; Wu, X.M. and Cao Y.X. (2004). Effects of exposing rabbits to low-intensity pulsed electromagnetic fields on levels of blood lipid and properties of hemorheology. *Chinese J. Clin. Rehabilitation*, 8(18): 3670-3671.
- 20- Bellossi, A.; Pouvreau-Quillien, V.; Rocher, C. and Ruellou, M. (1998). Effect of pulsed magnetic fields on triglyceride and cholesterol levels in plasma of rats. *Panminerva Med.*, 40(4): 276-279.
- 21- Kumosani T.A. and Qari M.H., (2003). The effect of magnetic field on the biochemical parameters of mice blood. *Pak. J. Med. Sci.*, 19(1): 36-40.
- 22- Berezin M. and Karasik A., (1995): Familial prolactinemia. *Clin Endocrinal* 42:483-486.
- 23- Grajewski B; Cox C, et al., (2000): Semen quality and hormone level among radiofrequency heater operators. *J Occup Environ Med*, 42:993-1005.
- 24- Yokus B; Cakir DU, Akdağ Z, (2005). Oxidative DNA damage in rats exposed to extremely low frequency electromagnetic fields. *Free Radical Res*; 39:317e323